THIS IS ONE VOLUME OF A SIX VOLUME SET WHICH INCLUDES:

VOLUME I: FIELD OPERATIONS (FO)
VOLUME II: GROUNDWATER (GW)
VOLUME III: GEOTECHNICAL (GT)
VOLUME IV: SURFACE WATER (SW)
VOLUME V: ECOLOGY (EE)
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Category 2	**Organization:**	**Environmental Management**

TITLE:
DISCHARGE MEASUREMENT

Approved By: _____ MAY 12 1992
(Name of Approver) (Date)

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2.0 PURPOSE AND SCOPE

This standard operating procedure (SOP) describes procedures that will be used at the Rocky Flats Plant (RFP) to measure surface water discharge in streams and ditches or from seeps and pipes. Discharge is defined as the volume rate of flow of water, including any substances suspended or dissolved in the water. This document outlines a set of standard methods for various flow conditions at RFP.

This SOP describes equipment and procedures that will be used for field data collection and documentation in order to attain acceptable standards of accuracy, precision, comparability, representativeness, and completeness.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

All personnel performing these procedures are required to have the appropriate health and safety training as specified in the site-specific Health and Safety Plan. Personnel obtaining surface water discharge measurements will be hydrologists, geologists, engineers or field technicians with an appropriate amount of applicable field experience or on-the-job training under the supervision of another qualified person.

4.0 REFERENCES

4.1 SOURCE REFERENCES

The following is a list of references reviewed prior to the writing of this procedure:

Driscoll, Fletcher G., Ph.D. Groundwater and Wells. Second edition. Johnson Filtration Systems, Inc., St. Paul, Minnesota. 1986.

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RIVER AND DITCH SAMPLING

EG&G ROCKY FLATS PLANT	Manual:	5-21000-OPS
EMD MANUAL OPERATION SOP	Procedure No.:	SW.15, Rev. 2
	Page:	1 of 13
	Effective Date:	March 1, 1992
Category 2	Organization:	Environmental Management

TITLE:
RIVER AND DITCH SAMPLING

Approved By: _____ MAY 12 1992
(Name of Approver) (Date)

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2.0 PURPOSE AND SCOPE

This standard operating procedure (SOP) describes procedures to be used in the collection of water samples from rivers, streams, and ditches located offsite from the Rocky Flats Plant (RFP) or at the RFP in support of National Pollutant Discharge Elimination System (NPDES) permit compliance at the RFP. This procedure sets forth methods for collection of samples at any specific site based upon physical characteristics and dimensions of the water body.

This SOP addresses the collection of representative ambient water quality samples that meet applicable regulations and appropriate sampling protocols. Applicable Federal and Department of Energy (DOE) regulations include:

- Rocky Flats Plant NPDES Permit Number CO-0001333
- 40 CFR Parts 122, 123, 125, 133, and 136
- DOE Order 5400.1
- RFP NPDES Federal Facilities Compliance Agreement

Sampling locations, sampling frequencies, and a list of analytes to be collected will be specified in the project field sampling plan.

3.0 RESPONSIBILITIES AND QUALIFICATIONS

Personnel performing river and ditch sampling will be geologists, hydrologists, engineers, or field technicians with an appropriate amount of applicable field experience or on-the-job training under supervision of another qualified person.

4.0 REFERENCES

4.1 SOURCE REFERENCES

The following is a list of references reviewed prior to the writing of this procedure:

MCD-51 NPDES Compliance Inspection Manual. U.S. Environmental Protection Agency. May 1988.

Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms. 3rd Edition. EPA/6000/4/85/013. March 1985.

Region VIII EPA NPDES Acute Test Conditions-Static Renewal Whole Effluent Toxicity.

Code of Federal Regulations. 40 CFR 136.

Methods for Chemical Analysis of Water and Waste. U.S. Environmental Protection Agency. 1979.

4.2 INTERNAL REFERENCES

Related SOPs cross-referenced by this SOP are as follows:

- SOP FO.3, General Equipment Decontamination
- SOP FO.7, Handling of Decontamination Water & Wash Water
- SOP FO.10, Receiving, Labeling, and Handling Environmental Materials Containers
- SOP FO.13, Containerizing, Preserving, Handling, and Shipping of Soil and Water Samples

- SOP SW.2, Field Measurement of Surface Water Field Parameters
- SOP SW.3, Surface Water Sampling

5.0 METHODS

Samples will be collected as either grab or composite samples. Grab sampling techniques include sample container immersion, "dip and transfer," and depth-integregated sampling. Samples for certain analytes are to be collected only by sample container immersion, while others may be collected by container immersion or the "dip and transfer" method. Depth-integrated (vertical areal composite) sampling is described in Subsection 5.3.1. Grab sampling methods are described in SOP SW.3, Surface Water Sampling.

The Equal Width Increment (EWI) method will be used to collect composite samples. This method, performed by wading in streams or by remote sampling, is described in Subsection 5.3.2.

The number of sampling points at each location will vary with the width and depth of the water body. In narrow streams, collection of a single depth-integrated sample at the deepest point may be sufficient. In wider streams or rivers, several subsamples (aliquots) will be combined to form a single composite sample, which is then divided into discrete samples. Refer to Subsection 5.2, Criteria for the Selection of Sampling Methods and Equipment, for details.

5.1 FIELD SAMPLING EQUIPMENT

Equipment used for collecting and compositing surface water samples from rivers and streams may include but is not limited to the following:

- DH-48 depth-integrated sampler
- DH-59 depth-integrated sampler

- USGS Churn Splitter
- Laboratory Provided Sample Containers
- Sample Transfer Devices

5.1.1 DH-48 and DH-59 Depth-Integrated Samplers

The DH-48 depth-integrated sampler, which will be used to collect samples when wading a stream or river, consists of a streamlined aluminum casting, 13 inches long, which partly encloses a sample container. The sampler, including the quart-size sample bottle, weighs 4.5 pounds. A standard stream-gauging wading rod is threaded into the top of the sampler body for suspending the sampler. Samples are collected through an intake nozzle and discharged into the bottle. The sampler can be used to collect water samples, except for those which must be collected as grab samples.

Although the sampler casting is made of aluminum, it will be acceptable for sampling because sample water will not come in contact with the aluminum. The intake nozzle should be made of inert material so no contamination of the sample takes place. Modification of the nozzle may be required to ensure that it is of an inert material. If high levels of aluminum are found in samples collected with this device, the DH-48 sampler will be investigated as a potential source.

The DH-59 is similar to the DH-48 sampler with some differences in application. Instead of having a wading rod attached, the device is equipped with a cable so that it can be remotely operated from bridges.

5.1.2 USGS Churn Splitter

The churn splitter is a device which mixes sample aliquots to form a sample composite and then splits the composite into discrete samples. Samples may be taken from the churn splitter for analysis of all dissolved and suspended inorganic constituents with the exception of total organic carbon

(TOC), fecal coliform, volatile organic analyses (VOCs), and oil and grease (O&G). The churn bucket should not be used as a direct sampling device; rather, water is collected in a depth-integrating sampler and poured into the churn splitter. The churn splitter is then used to mix the composited liquid while splitting the total volume into the various analyte samples.

Samples collected by the EWI method, described in Subsection 5.3.2, are composited and split in either an 8-liter or a 14-liter churn splitter. A total of 10 liters of the sample mixture can be withdrawn from the 14-liter churn; the remaining 4 liters should not be used directly because they will not be representative. Similarly, 5 liters can be withdrawn from the 8-liter churn. The sample mixture remaining in either churn can, however, be used for filtered samples. Unfiltered water samples should be withdrawn first and then filtered samples may be taken from the churn bucket with a peristaltic pump.

5.1.3 Laboratory Provided Sample Containers

Whenever possible, laboratory-provided sample containers will be used to collect water quality samples. Alternatively, the containers may be purchased from a supplier who certifies that bottles have been pre-cleaned to EPA specifications. Records certifying pre-cleaning will be kept for these containers.

5.1.4 Sample Transfer Devices

Beakers or dippers, composed of Teflon®, stainless steel, or glass, may be used if site conditions prevent sampling by sample container immersion. Procedures for the use of transfer devices for sample collection are described in SOP SW.3, Surface Water Sampling. The type, composition, and volume of the transfer device will be recorded in field notes.

5.2 CRITERIA FOR THE SELECTION OF SAMPLING METHODS AND EQUIPMENT

The selection of sampling methods and equipment is based on sample type, flow conditions, and data quality objectives stated in the field sampling plan.

Surface water samples that must be collected as grab samples and their sample collection methods are as follows:

- VOCs will be collected by container immersion or dipper with transfer.
- O&G will be collected by sample container immersion.

Selection of sampling methods and equipment based on flow conditions is as follows:

- If depth is less than 1.0 ft, samples will be collected using methods described in SOP SW.3, Subsection 5.3.2.2, Samples Collected by Container Immersion or Subsection 5.3.5, Sampling Under Low Flow Conditions.

- If depth is greater than 1.0 ft and the stream is less than 5 ft wide, use the vertical areal composite method described in Subsection 5.3.1 of this SOP.

- If depth is greater than 1.0 ft and the stream is at least 5 ft wide, use methods described in Subsection 5.3.2, EWI Method of Sampling for Dissolved Chemical Constituents of this SOP. The DH-48 sampler may be used for this method.

If a bridge spanning the river is available for sampling purposes or the stream cannot be waded safely, the EWI method should be employed along with remote sampling techniques described in Subsection 5.3.4, Remote Sampling, of SOP SW.3, Surface Water Sampling. The DH-59 sampler should be used for this procedure.

5.3 PROCEDURES

Samples will be collected from the same cross-section of the stream as that used for the discharge measurement if discharge is measured. Always collect samples prior to making discharge measurements.

The sample for total residual chlorine analysis will be collected prior to the collection of any other samples or measurement of any other parameters. Total residual chlorine will be measured, as described in SOP SW.2, Field Measurement of Surface Water Field Parameters, to determine if VOCs, cyanide, and Base Neutral Acid (BNA) samples require special preservatives. Refer to Subsection 5.4, Sample Containers, Preservation, and Handling.

5.3.1 Depth-Integrated Sampling

Depth-integrated grab samples (vertical areal composites) are collected for streams with depth greater than 1 ft and width less than 5 ft as follows:

- Locate the approximate center of flow in the stream, and position yourself facing upstream at this location.
- Lower open sample bottle to the bottom of the stream, taking care not to disturb bed materials, and raise it to the surface. The bottle should be lowered and raised at a uniform rate that allows the bottle to be completely filled as it reaches the surface.
- Recap and decontaminate the sample bottle exterior.

5.3.2 EWI Method of Sampling for Dissolved Chemical Constituents

The EWI method should be used where the width of the body of water to be sampled is greater than 5 ft and average depth is greater than 1.0 ft. The EWI method requires equal spacing of several sampling verticals across the cross-section and an equal transit rate (ETR), both up and down, in all verticals. The transit rate is the rate at which the DH-48 or similar sampler is lowered or raised along the water vertical. A proper transit rate is one that results in a full bottle when sampling at the vertical having the greatest unit width discharge. Verticals are the span between the water surface and the stream bottom at selected sampling points across the stream cross-section.

In the EWI method, the width of the stream is measured with an engineer's tape or with a tagline. A tagline is a measurement device for wide (greater than 25 ft.) streams. Typically, a steel engineer's tape with 1-foot and 0.1-foot increments will suffice. The tape or tagline is suspended about 1 foot above, and across the stream perpendicular to the direction of flow, to permit measurement and division into sampling intervals.

Guidelines for the collection of water samples using the EWI method are as follows:

- Suspend a measuring tape or tagline across the stream, about 1 foot from the water surface, perpendicular to the direction of flow.

- Visually inspect the stream from bank to bank, observing the velocity and depth distribution as well as apparent distribution of sediment in the cross-section.

- Determine the number of intervals to be sampled, based on stream width, velocity, depth, and the volume of sample required. Three to 5 intervals should be sufficient for most streams. If the stream has fairly uniform velocity and depth, and

the width is less than 25 feet, 3 intervals may be used. More intervals should be added for streams that are not uniform in velocity or depth.

- Assemble the DH-48 depth integrated sampler, and decontaminate the sampler according to SOP FO.3, General Equipment Decontamination.

- Locate the vertical containing the largest discharge. This is generally the vertical with the highest flow velocity, and is located near the center of the stream.

- Determine the transit rate for the maximum discharge vertical.

- Determine the width of the segment to be sampled (the distance between verticals) by dividing the stream width by the number of verticals selected.

- Record the bank closest to the first sampling station and the time at which sampling begins. Time is recorded to the nearest 5 minutes in military time.

- Move sampling and support equipment to the first station to be sampled. The sampling verticals will be located at the center of the cross-section intervals. For example, if the interval width is 10 feet, the first station will be 5 feet from the stream bank. The second station will be 15 feet from the bank.

- Collect samples for chemical constituents in one-quart bottles. More than one vertical may be sampled using the same bottle (in verticals of lower discharge) until the volume is about 3 inches from the top of the bottle. Do not add more than this because the sample will no longer be representative. If overfilling should occur, the bottle should be emptied, rinsed with a small volume of sample water, and the sample should be taken again. After collecting the sample, empty the

bottle contents into the churn splitter. Replace the bottle in the sampler and continue sampling in the same manner until all of the verticals have been sampled.

- Individual samples for the determination of chemical constituents (except those for VOCs, and O&G) should be composited in the churn splitter.

- Record the bank closest to the final sampling station and the time, to the nearest 5 minutes, at which sampling was completed.

- Disassemble and decontaminate sampling equipment according to SOP FO.3, General Equipment Decontamination.

5.4 SAMPLE CONTAINERS, PRESERVATION, AND HANDLING

A list of containers, preservatives, and holding times for sample parameters is included in SOP FO.13, Containerizing, Preserving, Handling, and Shipping of Soil and Water Samples. These requirements are based on 40 CFR 136, and regulations governing the collection of NPDES samples, and will take precedence over any conflicting information given in other guidance or SOP when collecting off-site samples. Procedures discussed in SOP FO.13, Containerizing, Preserving, Handling, and Shipping of Soil and Water Samples will be followed for the handling and shipping of collected samples.

6.0 DECONTAMINATION

Procedures for decontamination are set forth in the site-specific health and safety plan and SOP FO.3, General Equipment Decontamination, SOP FO.7, Handling of Decontamination Water and Wash Water, and SOP FO.10, Receiving, Labeling, and Handling Environmental Materials Containers.

7.0 QUALITY ASSURANCE/QUALITY CONTROL

Quality Assurance (QA) and Quality Control (QC) will be accomplished according to SOP SW.3, Surface Water Sampling, Section 7.0, Quality Assurance/Quality Control. Additional QA/QC requirements may be added if it is determined they are needed to ensure the quality of the data.

8.0 DOCUMENTATION

Information required by this SOP will be documented on the Surface Water Data Collection Field Notes form SW.1A, included in SOP SW.1, Surface Water Data Collection Activities or in field logbooks. Logbooks should include any information regarding sampling activities that is not required on form SW.1A, including; sampling times, deviation from procedures, or any other relevant information.